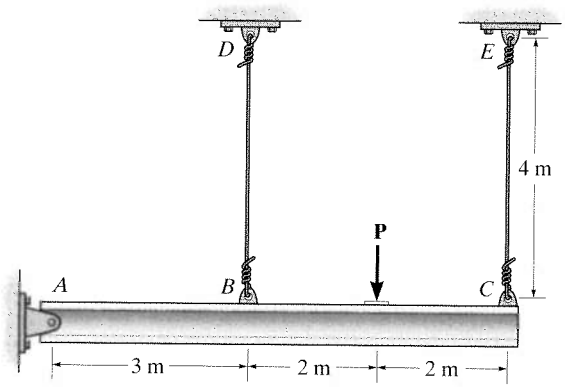
PROBLEMS

2–1. An air-filled rubber ball has a diameter of 6 in. If the air pressure within it is increased until the ball's diameter becomes 7 in., determine the average normal strain in the rubber.

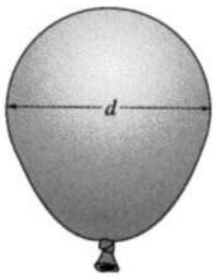
2–2. A thin strip of rubber has an unstretched length of 15 in. If it is stretched around a pipe having an outer diameter of 5 in., determine the average normal strain in the strip.

2–3. The rigid beam is supported by a pin at A and wires BD and CE. If the load **P** on the beam causes the end C to be displaced 10 mm downward, determine the normal strain developed in wires CE and BD.



Prob. 2–3

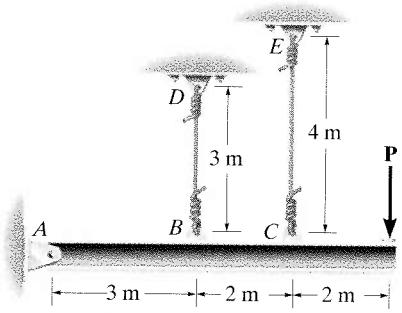
***2–4.** The center portion of the rubber balloon has a diameter of $d = 4$ in. If the air pressure within it causes the balloon's diameter to become $d = 5$ in., determine the average normal strain in the rubber.



Prob. 2–4

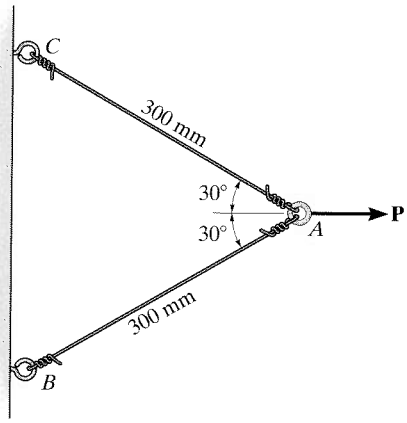
2–5. The rigid beam is supported by a pin at A and wires BD and CE. If the load **P** on the beam is displaced 10 mm downward, determine the normal strain developed in wires CE and BD.

2–6. The rigid beam is supported by a pin at A and wires BD and CE. If the maximum allowable normal strain in each wire is $\epsilon_{max} = 0.002$ mm/mm, determine the maximum vertical displacement of the load **P**.



Probs. 2–5/6

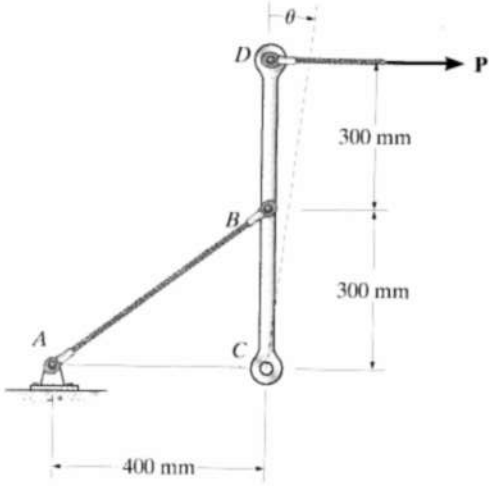
2–7. The two wires are connected together at A. If the force **P** causes point A to be displaced horizontally 2 mm, determine the normal strain developed in each wire.



Prob. 2–7

*2–8. Part of a control linkage for an airplane consists of a rigid member CBD and a flexible cable AB. If a force is applied to the end D of the member and causes it to rotate by $\theta = 0.3°$, determine the normal strain in the cable. Originally the cable is unstretched.

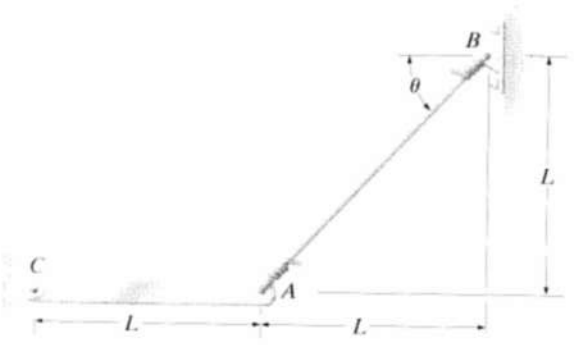
2–9. Part of a control linkage for an airplane consists of a rigid member CBD and a flexible cable AB. If a force is applied to the end D of the member and causes a normal strain in the cable of 0.0035 mm/mm, determine the displacement of point D. Originally the cable is unstretched.



Probs. 2–8/9

2–10. The wire AB is unstretched when $\theta = 45°$. If a vertical load is applied to bar AC, which causes $\theta = 47°$, determine the normal strain in the wire.

2–11. If a load applied to bar AC causes point A to be displaced to the left by an amount ΔL, determine the normal strain in wire AB. Originally, $\theta = 45°$.

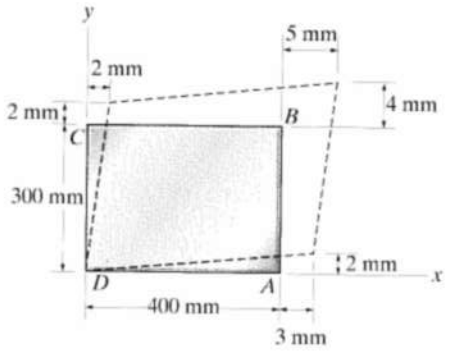


Probs. 2–10/11

*2–12. The piece of plastic is originally rectangular. Determine the shear strain γ_{xy} at corners A and B if the plastic distorts as shown by the dashed lines.

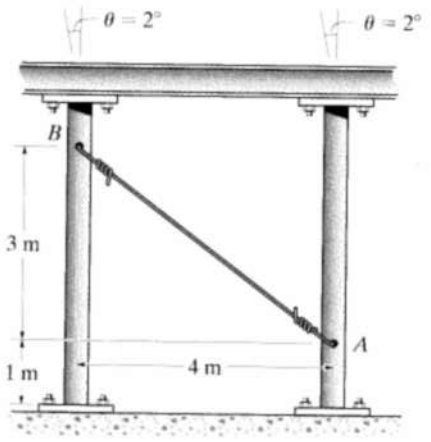
2–13. The piece of plastic is originally rectangular. Determine the shear strain γ_{xy} at corners D and C if the plastic distorts as shown by the dashed lines.

2–14. The piece of plastic is originally rectangular. Determine the average normal strain that occurs along the diagonals AC and DB.



Probs. 2–12/13/14

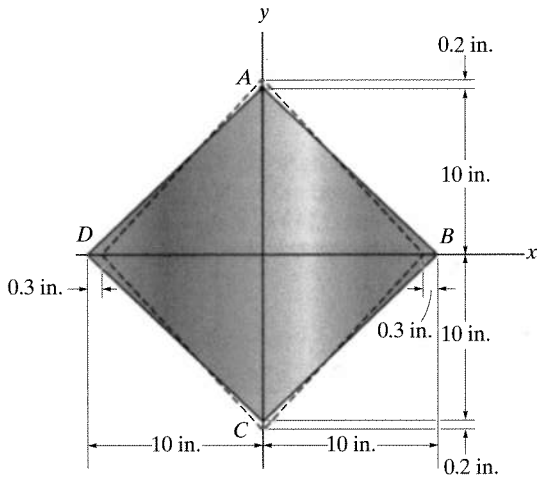
2–15. The guy wire AB of a building frame is originally unstretched. Due to an earthquake, the two columns of the frame tilt $\theta = 2°$. Determine the approximate normal strain in the wire when the frame is in this position. Assume the columns are rigid and rotate about their lower supports.



Prob. 2–15

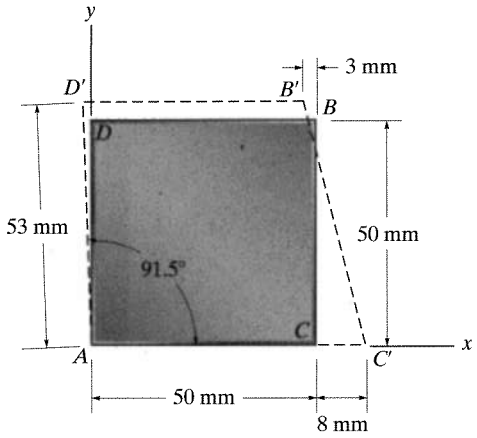
*2–16. The corners of the square plate are given the displacements indicated. Determine the shear strain along the edges of the plate at A and B.

2–17. The corners of the square plate are given the displacements indicated. Determine the average normal strains along side AB and diagonals AC and DB.



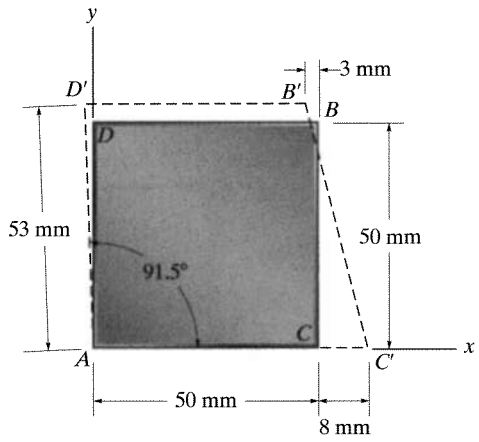
Probs. 2–16/17

2–18. The square deforms into the position shown by the dashed lines. Determine the average normal strain along each diagonal, AB and CD. Side $D'B'$ remains horizontal.



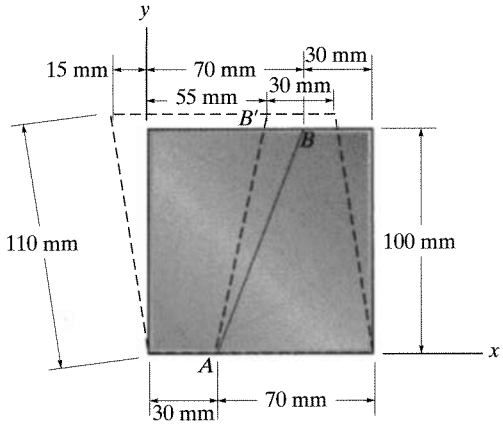
Prob. 2–18

2–19. The square deforms into the position shown by the dashed lines. Determine the shear strain at each of its corners, A, B, C, and D. Side $D'B'$ remains horizontal.



Prob. 2–19

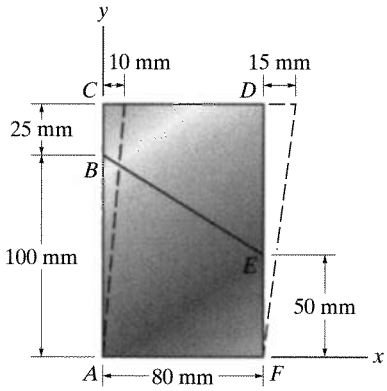
*2–20. The block is deformed into the position shown by the dashed lines. Determine the average normal strain along line AB.



Prob. 2–20

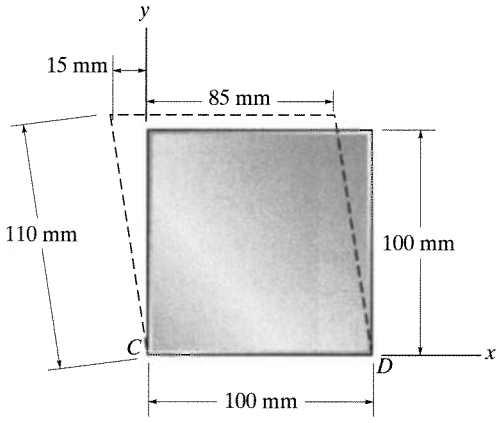
2–27. The material distorts into the dashed position shown. Determine (a) the average normal strains ϵ_x, ϵ_y and the shear strain γ_{xy} at A, and (b) the average normal strain along line BE.

***2–28.** The material distorts into the dashed position shown. Determine the average normal strain that occurs along the diagonals AD and CF.



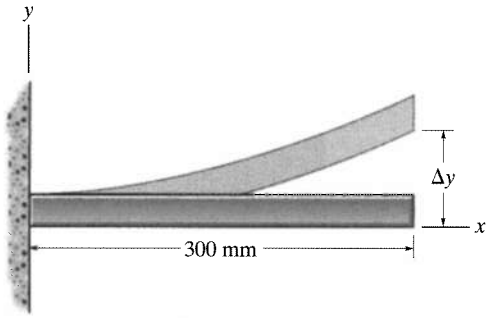
Probs. 2–27/28

2–29. The block is deformed into the position shown by the dashed lines. Determine the shear strain at corners C and D.



Prob. 2–29

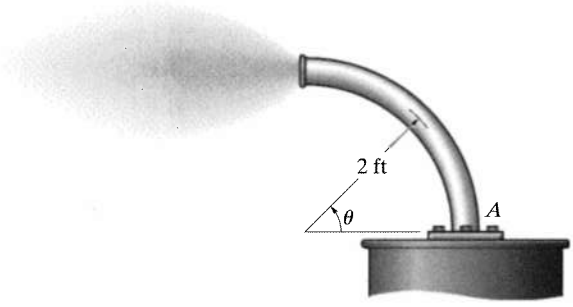
2–30. The bar is originally 300 mm long when it is flat. If it is subjected to a shear strain defined by $\gamma_{xy} = 0.02x$, where x is in millimeters, determine the displacement Δy at the end of its bottom edge. It is distorted into the shape shown, where no elongation of the bar occurs in the x direction.



Prob. 2–30

2–31. The curved pipe has an original radius of 2 ft. If it is heated nonuniformly, so that the normal strain along its length is $\epsilon = 0.05 \cos \theta$, determine the increase in length of the pipe.

***2–32.** Solve Prob. 2–31 if $\epsilon = 0.08 \sin \theta$.



Probs. 2–31/32